

Claims

1-13. (canceled)

14. (previously presented) A ball grid array (BGA) package, comprising:

a stiffener that has a surface, wherein said surface is capable of mounting an integrated circuit (IC) die in a central area, wherein at least a portion of said surface is patterned to enhance the adhesiveness of an encapsulant material to said surface.

15. (previously presented) The package of claim 14, wherein said at least a portion of said surface is patterned with a dimple design.

16. (previously presented) The package of claim 15, wherein said dimple design includes a plurality of protruding dimples.

17. (previously presented) The package of claim 15, wherein said dimple design includes a plurality of indented dimples.

18. (previously presented) The package of claim 15, wherein said dimple design includes at least one indented dimple and at least one protruding dimple.

19. (previously presented) The package of claim 14, further comprising:

an IC die mounted to said central area of said surface; and

an encapsulant material applied to said surface and said mounted IC die to encapsulate said mounted IC die on said surface, wherein said encapsulant material adheres to said patterned at least a portion of said surface.

20. (previously presented) The package of claim 19, wherein said encapsulant material is an epoxy or molding compound.

21. (previously presented) The package of claim 14, wherein said stiffener includes at least one metal.

22. (previously presented) The package of claim 21, wherein said at least one metal includes at least one of copper and aluminum.

23. (previously presented) The package of claim 14, wherein said stiffener includes a ceramic.

24. (previously presented) A ball grid array (BGA) package, comprising:

a first stiffener that has a substantially planar surface;

a second stiffener that has opposing first and second surfaces, wherein said first surface of said second stiffener is substantially planar and is attached to said surface of said first stiffener; and

a substrate that has a surface attached to said second surface of said second stiffener.

25. (previously presented) The package of claim 24, wherein said first stiffener is configured to operate as a first ground plane, and said second stiffener is configured to operate as a second ground plane.

26. (previously presented) The package of claim 25, wherein said first ground plane and said second ground plane are electrically isolated.

27. (previously presented) The package of claim 26, wherein said first ground plane is a floating ground plane and said second ground plane is a solid ground plane.

28. (previously presented) The package of claim 24, wherein said first stiffener is coupled to a first potential and said second stiffener is coupled to a second potential.

29. (previously presented) The package of claim 28, wherein at least one of said first potential and said second potential is a ground potential.

30. (previously presented) The package of claim 28, wherein at least one of said first potential and said second potential is a positive voltage.

31. (previously presented) The package of claim 24, further comprising:

an IC die mounted to a second surface of said first stiffener;

a wire bond coupled between a contact pad of said IC die and said second surface of said first stiffener.

32. (previously presented) The package of claim 31, further comprising a second wire bond coupled between a second contact pad of said IC die and said first surface of said second stiffener.

33. (previously presented) The package of claim 32, wherein said first stiffener includes an opening through said stiffener that is open at said first surface of said first stiffener and said second surface of said first stiffener, wherein said second wire bond is coupled between said second contact pad of said IC die and said first surface of said second stiffener through said opening.

34. (previously presented) The package of claim 24, further comprising:
an IC die mounted to a second surface of said first stiffener;
a wire bond coupled between a contact pad of said IC die and said first surface of said second stiffener.

35. (previously presented) The package of claim 34, wherein said first stiffener includes an opening through said stiffener that is open at said first surface of said first stiffener and said second surface of said first stiffener, wherein said wire bond is coupled between said contact pad of said IC die and said first surface of said second stiffener through said opening.

36. (previously presented) The package of claim 24, wherein said first stiffener and said second stiffener include at least one metal.

37. (previously presented) The package of claim 36, wherein said at least one metal includes at least one of copper and aluminum.

38. (previously presented) The package of claim 24, wherein said first stiffener and said second stiffener includes a ceramic.

39. (previously presented) A ball grid array (BGA) package, comprising:

a substrate that has opposing first and second surfaces, wherein said substrate has a window opening through said substrate that is open at said first surface and said second surface;

a stiffener that has a surface attached to said second surface of said substrate; and

a heat slug that has a first surface attached to a portion of said surface of said stiffener through said window opening, wherein said heat slug has a second surface that is capable of being mounted to a printed circuit board (PCB);

wherein said stiffener includes a first portion of a locking mechanism and said heat slug includes a second portion of said locking mechanism, wherein said locking mechanism aligns said heat slug with said stiffener when coupled together.

40. (previously presented) The package of claim 39, wherein said second portion of said locking mechanism includes a surface bump on said first surface of said heat slug; and

wherein said first portion of said locking mechanism includes a slot in said portion of said surface of said stiffener that corresponds to said surface bump;

wherein said surface bump fits into said slot when said surface of said heat slug is coupled to said portion of said surface of said stiffener through said window opening.

41. (previously presented) The package of claim 40, wherein said locking mechanism further includes an adhesive material to adhere said surface bump in said slot.

42. (previously presented) The package of claim 39, wherein said first portion of said locking mechanism includes a surface bump on said portion of said surface of said stiffener; and

wherein said second portion of said locking mechanism includes a slot in said first surface of said heat slug that corresponds to said surface bump;

wherein said surface bump fits into said slot when said first surface of said heat slug is coupled to said portion of said surface of said stiffener through said window opening.

43. (previously presented) The package of claim 42, wherein said locking mechanism further includes an adhesive material to adhere said surface bump in said slot.

44. (withdrawn) A method for assembling a ball grid array (BGA) package, comprising the steps of:

(A) providing a stiffener that has opposing first and second surfaces, wherein the first surface is capable of mounting an integrated circuit (IC) die in a central area; and

(B) forming a pattern in at least a portion of the first surface to enhance the adhesiveness of an encapsulant material to the first surface.

45. (withdrawn) The method of claim 44, wherein step (B) comprises the step of:

(1) forming a dimple design in the at least a portion of the first surface.

46. (withdrawn) The method of claim 45, wherein step (1) comprises the step of:

forming a plurality of protruding dimples in the at least a portion of the first surface.

47. (withdrawn) The method of claim 45, wherein step (1) comprises the step of:

forming a plurality of indented dimples in the at least a portion of the first surface.

48. (withdrawn) The method of claim 45, wherein step (1) comprises the step of:

forming at least one indented dimple and at least one protruding dimple in the at least a portion of the first surface.

49. (withdrawn) The method of claim 45, further comprising the steps of:

(C) mounting an IC die to the central area of the first surface; and

(D) applying an encapsulant material to the mounted IC die and to the first surface to encapsulate the mounted IC die on said first surface.

50. (withdrawn) The method of claim 49, wherein step (D) comprises the step of:

 applying the encapsulant material to the dimple design to enhance

the adhesiveness of the encapsulant material to the first surface.

51. (withdrawn) A method of assembling ball grid array (BGA) package,

comprising the steps of:

 (A) attaching a surface of a first stiffener to a first surface of a second

stiffener; and

 (B) attaching a surface of a substrate to a second surface of the second

stiffener.

52. (withdrawn) The method of claim 51, wherein step (B) includes the step of:

 electrically isolating the first stiffener and second stiffener.

53. (withdrawn) The method of claim 51, further comprising the steps of:

 (C) configuring the first stiffener to operate as a first ground plane; and

 (D) configuring the second stiffener to operate as a second ground plane.

54. (withdrawn) The method of claim 53, wherein step (C) comprises the step of

configuring the first stiffener to operate as a floating ground plane; and

 wherein step (D) comprises the step of configuring the second stiffener to operate

as a solid ground plane.

55. (withdrawn) The method of claim 51, further comprising the steps of:

- (C) coupling the first stiffener to a first potential; and
- (D) coupling the second stiffener to a second potential.

56. (withdrawn) The method of claim 55, wherein step (C) comprises the step of:

coupling the first stiffener to a ground potential.

57. (withdrawn) The method of claim 55, wherein step (C) comprises the step of:

coupling the first stiffener to a positive voltage level.

58. (withdrawn) The method of claim 51, further comprising:

- (C) mounting an IC die a second surface of the first stiffener; and
- (D) coupling a wire bond between a contact pad of the IC die and the second surface of the first stiffener.

59. (withdrawn) The method of claim 58, further comprising:

- (E) coupling a second wire bond between a second contact pad of the IC die and the first surface of the second stiffener.

60. (withdrawn) The method of claim 51, further comprising:

- (C) mounting an IC die a second surface of the first stiffener; and
- (D) coupling a wire bond between a contact pad of the IC die and the first surface of the second stiffener.

61. (withdrawn) A method of assembling a ball grid array (BGA) package, comprising the steps of:

(A) attaching a surface of a stiffener to a surface of a substrate that has a window opening therethrough to allow a portion of the surface of the stiffener to be accessed through the window opening; and

(B) attaching a first surface of a heat slug to the accessible portion of the surface of the stiffener through the window opening, wherein the heat slug has a second surface that is capable of being mounted to a printed circuit board (PCB);

wherein step (B) includes the step of

(1) aligning the first surface of the heat slug with the accessible portion of the surface of the stiffener using a locking mechanism.

62. (withdrawn) The method of claim 61, wherein step (1) includes the step of:

fitting a surface bump on the first surface of the heat slug into a slot on the accessible portion of the surface of the stiffener.

63. (withdrawn) The method of claim 62, wherein step (B) further includes the step of:

(2) using an adhesive to adhere the surface bump in the slot.

64. (withdrawn) The method of claim 61, wherein step (1) includes the step of:

fitting a surface bump on the accessible portion of the surface of the stiffener into a slot on the first surface of the heat slug.

65. (withdrawn) The method of claim 64, wherein step (B) further includes the step of:

(2) using an adhesive to adhere the surface bump in the slot.

66. (withdrawn) A method for a forming a locking mechanism to align a stiffener with a heat slug in a ball grid array (BGA) package, comprising the steps of:

forming a bump on a surface of the heat slug; and

forming a slot in the surface of the stiffener, wherein the bump is capable of fitting into the slot when the surface of the heat slug is attached to the surface of the stiffener.

67. (withdrawn) A method for a forming a locking mechanism to align a stiffener with a heat slug in a ball grid array (BGA) package, comprising the steps of:

forming a bump on a surface of the stiffener; and

forming a slot in the surface of the heat slug, wherein the bump is capable of fitting into the slot when the surface of the heat slug is attached to the surface of the stiffener.